Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SHOUT
SHARE
IT

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 1056

Contribution from the Bureau of Markets and Crop Estimates
H. C. TAYLOR, Chief

Washington, D. C. ▼ April 5, 1922

MARKETING COTTON SEED FOR PLANTING PURPOSES.

By J. E. Barr, *Investigator in Marketing Seeds.*

CONTENTS.

	Page.		Page
Sources of supply	2	The shipping tag	20
Selection of seed stocks	3	The lot number	20
Preparation	4	Selling	21
Ginning	4	Extravagant claims undesirable	21
Delinting	5	True names for varieties	22
Recleaning and grading	12	Renaming varieties	22
Sacking	16	Sales on basis of weight vs. measure	22
Storage	16	Certified cotton seed	23
Warehouse should be ventilated	17	Summary	23
Storing in sacks	17		
Stacking	18		
Germination	18		
Causes of low germination	19		
Making tests	19		

The area devoted to the production of cotton in the United States annually averages 35,000,000 acres. To plant this acreage requires approximately 500,000 tons or a billion pounds of seed, about one-tenth of the average total annual production. It has been estimated that normally 30 per cent of this total planting requirement is obtained by farmers from commercial sources, 70 per cent being produced on the farm where used.

The number of persons and concerns dealing in cotton seed for planting purposes and the total volume of their annual business have increased steadily. However, comparatively little effort has been made to improve the commercial and agricultural value of their stock. It is true that a limited number of growers and dealers are endeavoring to develop either new varieties or improved strains of standard varieties; but the possibilities of enhancing the commercial and agricultural value of cotton seed by better methods of preparing, storing, and marketing have been overlooked or neglected. As a

result the average commercial cotton seed of to-day used for planting does not measure up to a high standard.

The seed dealer's place in the channels of trade is justified largely by services rendered in improving the quality of his product. If his stock is no improvement over the average farmer's stock, farmers will continue to be more or less skeptical regarding it, on the basis of the increased prices usually asked. On the other hand, if commercial cotton seed for planting possesses superior qualities and honest efforts are made to prove its superiority, skepticism regarding its true value will not long remain in the minds of farmers. There is rarely, if ever, an oversupply of really superior seed and no effort should be spared by commercial agencies and others to make the term "planting cotton seed" stand for something of infinitely greater agricultural value than the average cotton seed now used for planting, and thereby to render a distinct service to the cotton-growing industry.

The ideal planting cotton seed may be described as seed selected from cotton that is true to type and pure of variety; well matured; free from disease and insects or insect injury; delinted; recleaned and graded; and with a minimum germination of 88 per cent. By pointing out some of the fundamental points in selecting, improved methods of preparing and storing, and ways of overcoming or eliminating some of the existing unfair and unscrupulous practices in selling planting cotton seed, all classes of dealers may be aided in making their product approach more closely the ideal and farmers may be guided in determining its intrinsic value when making purchases.

SOURCES OF SUPPLY.

The percentage of the total planting requirement of cotton seed that is sold commercially varies from year to year and is influenced largely by one or more of the following factors: (1) Extent of boll weevil and pink boll worm injury and expansion of the area infested, which creates an abnormal demand for seed of early maturing varieties grown in noninfested territory; (2) excessive and continued rains during the harvest period, adversely affecting the germination; (3) unfavorable weather conditions during the planting season, necessitating more or less replanting; (4) general prosperity of the cotton farmer; and (5) spasmodic changes in the acreage. The percentage obtained by farmers from commercial sources also varies greatly in the several cotton-producing States, as shown in Table 1:

TABLE 1.—*Sources from which farmers obtain planting cotton seed and estimated normal percentage and quantity obtained from each source.*

State.	Total quantity required for planting.	Produced on farm where used.		Obtained from other farmers.		Obtained from dealers.	
	Pounds.	Per cent.	Pounds.	Per cent.	Pounds.	Per cent.	Pounds.
Virginia	1,755,000	47	825,000	16	281,000	37	649,000
North Carolina	54,648,000	69	37,707,000	17	9,290,000	14	7,651,000
South Carolina	100,695,000	80	80,556,000	13	13,090,000	7	7,049,000
Georgia	163,614,000	80	130,891,000	12	19,634,000	8	13,089,000
Florida	2,626,000	34	893,000	15	394,000	51	1,339,000
Missouri	4,736,000	23	1,089,000	13	616,000	64	3,031,000
Tennessee	29,664,000	70	20,765,000	13	3,856,000	17	5,043,000
Alabama	93,786,000	76	71,277,000	11	10,317,000	13	12,192,000
Mississippi	99,792,000	80	79,834,000	10	9,979,000	10	9,979,000
Louisiana	50,470,000	76	38,357,000	13	6,561,000	11	5,552,000
Texas	314,400,000	56	176,064,000	13	40,872,000	31	97,464,000
Oklahoma	66,360,000	46	30,526,000	20	13,272,000	34	22,562,000
Arkansas	100,170,000	70	70,119,000	23	23,039,000	7	7,012,000
Arizona	4,470,000	27	1,280,000	11	521,000	62	2,939,000
California	2,980,000	9	268,000	6	179,000	85	2,533,000
United States	1,090,436,000	68	740,451,000	14	151,901,000	18	198,084,000

The percentage shown as obtained direct from other farmers is considered commercial seed and is included in all references to commercial seed in this discussion. The quantities given in the table are based on the 1920 acreage and the reported average rate of seeding per acre in each State.

SELECTION OF SEED STOCKS.

The production of planting cotton seed is so closely allied with the marketing of it that a line of demarcation between the two activities is difficult to draw. The agricultural value of the finished product sold depends in a large measure on the growing crop and the stock seed from which it is produced. The stock seed should compare favorably with the "ideal." It should come direct from the originator of that particular variety, or the conditions under which it has been handled and propagated since leaving the originator's hands should conform with approved methods of growing and selecting cotton seed for planting purposes.[1] The dealer should maintain close cooperation with the grower and have direct supervision over the growing crop. To this end advance growing contracts may be advantageous. Rogueing the fields one or more times prior to and during blossoming time is desirable in order to remove all barren, diseased, and off-type plants.[2]

The cotton from which seed is selected should be well-matured and dry when picked. Seed from the top bolls on the plants and from

[1] Distribution of Cotton Seed in 1921, U. S. Department of Agriculture Circular 151. 1920.

[2] Cook, O. F.: Cotton Selection on the Farm by the Characters of the Stalks, Leaves, and Bolls. Bureau of Plant Industry Circular No. 66. 1910.

cotton harvested late in the season, after frosts and storms, almost invariably is of low vitality and of poor quality for planting purposes. If a field contains a high percentage of diseased plants this fact immediately disqualifies it as a source of planting seed supply. Also, any appreciable damage by the boll weevil and pink boll worm renders cotton seed unfit for planting purposes even in infested territory, while quarantine measures prohibit the shipment and sale of cotton seed from infested areas into noninfested territory.

PREPARATION.

Cotton seed, unlike most other leading field seeds, continues to be sold and planted in a rather crude physical condition. Dealers seem to overlook the fact that commercial cotton seed of the most carefully selected and improved strains can be made of still greater value from the farmers' point of view by the use of modern machinery in ginning, delinting, and recleaning and grading. The commercial advantages of better preparation are measured by the agricultural advantages accruing to the farmer planting the better prepared seed. If it does not mean a larger net profit to the farmer by promoting more economical production or a greater yield, the increased cost is not justified. On the other hand when it is evident that a process or method of improving the physical condition of cotton seed enhances its value for planting purposes, it is incumbent on the dealer to use the process. A reduction of 100,000 tons of cotton seed in the annual seeding requirement and a saving of 30,000,000 pounds of linters, now a total waste, for industrial purposes, would result through the more thorough and uniform removal of the surplus lint and the culling out of all extraneous matter and small and lightweight inferior seed by the application of such methods as are now available.

GINNING.

The first mechanical operation affecting the appearance and physical condition of cotton seed is ginning.[3] Improvements in ginning machinery during recent years enable the operator to produce much cleaner seed than formerly. Most of the sand, dirt, burs, and other foreign material is removed automatically. The most modernly equipped gin plant, however, will not turn out seed in the best condition unless a thoroughly competent operator is in charge and unless the cotton to be ginned is fully matured and dry. There are thousands of gins in the cotton belt but relatively few skilled operators who appreciate the importance of improving the physical condition

[3] Taylor, Fred, Griffith, D. C., and Atkinson, C. E.: Cotton Ginning Information for Farmers, U. S. Department of Agriculture, Farmers' Bulletin 764. 1916.

and preserving the varietal purity and identity of cotton seed to be used or sold for planting purposes.

No attempt should be made to gin cotton that is "green" or that has become damp, as it is difficult to prevent the seed from such cotton from becoming "heated" in storage. An important precautionary measury which always should be kept in mind is the prevention of the admixture of varieties at the gin. Before changing from one variety to another the roll box should be emptied and, together with the flues, feeders, conveyers, bins, should be thoroughly cleaned. This factor has been discussed fully in a previous publication of the United States Department of Agriculture.[4]

DELINTING.

Delinting is one of the most important factors essential to the preparation of the ideal planting cotton seed. It is evident that any process which removes the surplus lint without impairing the germination is of prime importance in the improvement of cotton seed for planting purposes and the same interest should be manifested in delinting as in maintaining the purity of variety, trueness to type, or other factors pertaining to the cotton from which the seed is selected.

From a commercial point of view, delinting offers dealers an opportunity to improve the quality and intrinsic value of their product and to maintain the grade of it at a higher level than the average farmer's stock or what is termed "gin-run" seed.

AGRICULTURAL ADVANTAGES.

The delinting process offers decided possibilities for bettering agricultural practice. It promotes a uniform stand of plants by enabling the seed to germinate more quickly and with the aid of less moisture. In "gin-run" seed, regardless of variety or strain, there is usually a wide variation in the quantity of lint left on the individual seeds, as is shown in figure 1, *a* and *c*. When planted, the seeds with the shortest lint on them come into closer contact with the soil moisture and germinate more quickly than those containing excessive lint. The delinted seeds, containing a small, uniform quantity of very short lint or fuzz (see figure 1, *b* and *d*), germinate at practically the same time and produce a more nearly perfect stand of plants at least two or three days earlier. This is of value in growing cotton in the presence of the boll weevil because every day gained in getting the plants above the ground increases the prospects of obtaining a profitable yield. Delinting materially assists in the emergence of cotton seedlings. In germinating the seed is forced up

[4] Saunders, D. A., and Cardon, P. V.: Custom Ginning as a Factor in Cottonseed Deterioration, U. S. Department of Agriculture, Bulletin 288. 1915.

through the soil on the cotyledons of the cotton seedlings and a closely delinted seed offers less resistance than gin-run seed. Also the united action of the young plants, resulting from the simultaneous

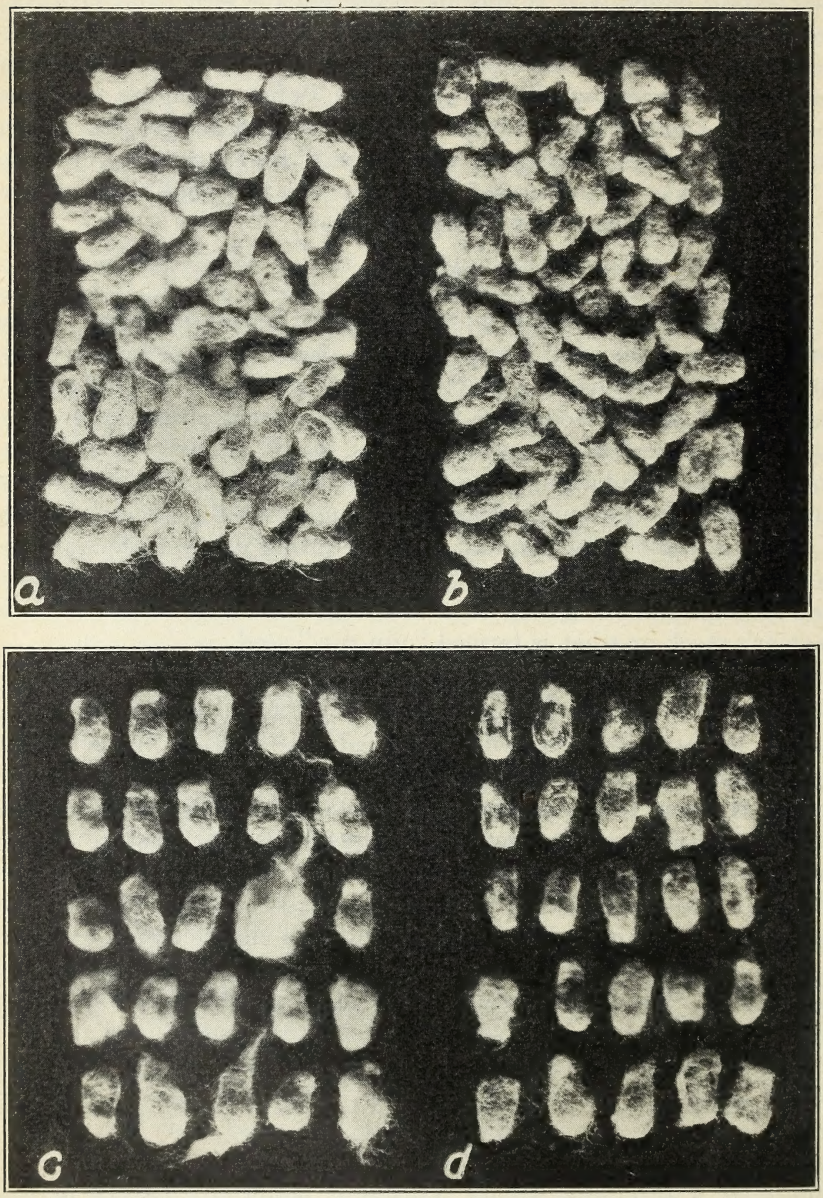

FIG. 1.—Cotton seed. *a* and *c*, Gin-run; *b* and *d*, delinted. All natural size.

germination of the delinted seeds, enables them to break through soil that has been compacted by rains with comparatively little difficulty and helps to insure a stand of plants under adverse conditions.

Delinting effects an economy in the use of cotton seed, as planting machines will distribute a smaller quantity per acre more uniformly. It will eliminate the necessity of a force feed in planting machines and facilitate the single-seed distribution and the planting of cotton seed in hills. The thin uniform stand, made possible by the use of delinted seed, also may help to simplify the culture of cotton by what is known as the single stalk method [5] which, repeated experiments show,[6] produces the highest yields and earliest maturity.

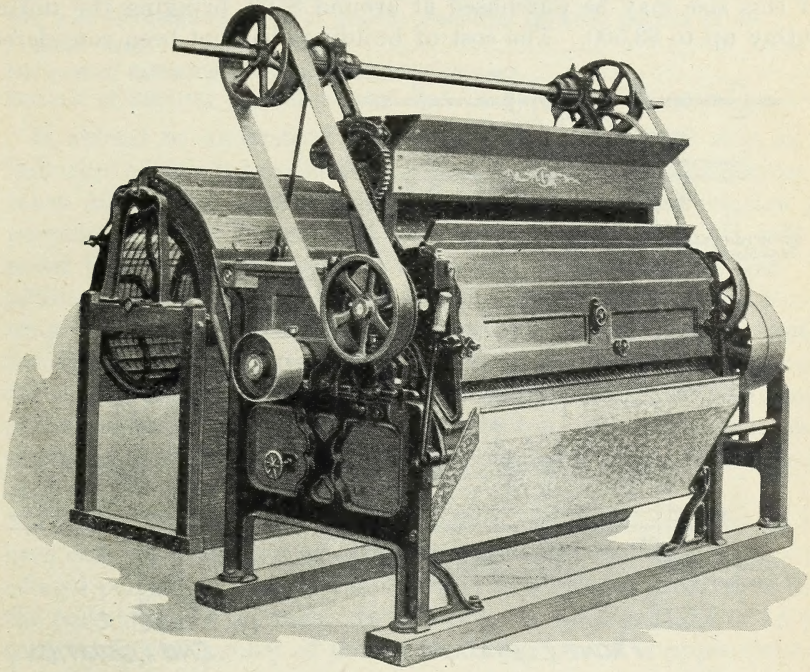

FIG. 2.—A type of machine used in delinting cotton seed.

COST OF DELINTING.

The cost of delinting, which on first thought may be expected to be excessive, is small per unit. It necessarily varies with the capacity of the plant and the quantity of seed handled or the number of days the plant is operated during a season. A plant may be installed in a dealer's warehouse and operated separately or installed and operated in connection with a ginnery. The kind of machine used is the same as that for delinting cotton seed for oil manufacture and is

[5] Cook, O. F.: A New System of Cotton Culture and its Application, U. S. Department of Agriculture, Farmers' Bulletin 601. 1914.

[6] Cardon, P. V.: Experiments with Single-Stalk Cotton Culture in Louisiana, Arkansas, and North Carolina, U. S. Department of Agriculture, Bulletin 526. 1918. Meade, R. M.: Single-Stalk Cotton Culture at San Antonio, U. S. Department of Agriculture, Bulletin 279. 1915.

illustrated in figure 2. Based on careful estimates submitted by manufacturers, the initial investment in machinery for a plant having a capacity of four tons per 10 hours should be about $3,000. This amount would cover the purchase price and cost of installing the machinery, consisting of two delinting machines, press, and the necessary conveyers, elevators, and transmission equipment. The cost of the motor or other source of power is not included. Such a plant requires from 15 to 20 horsepower to operate it and a motor of this size may be purchased at around $500, bringing the initial outlay up to $3,500. The cost of buildings has not been considered

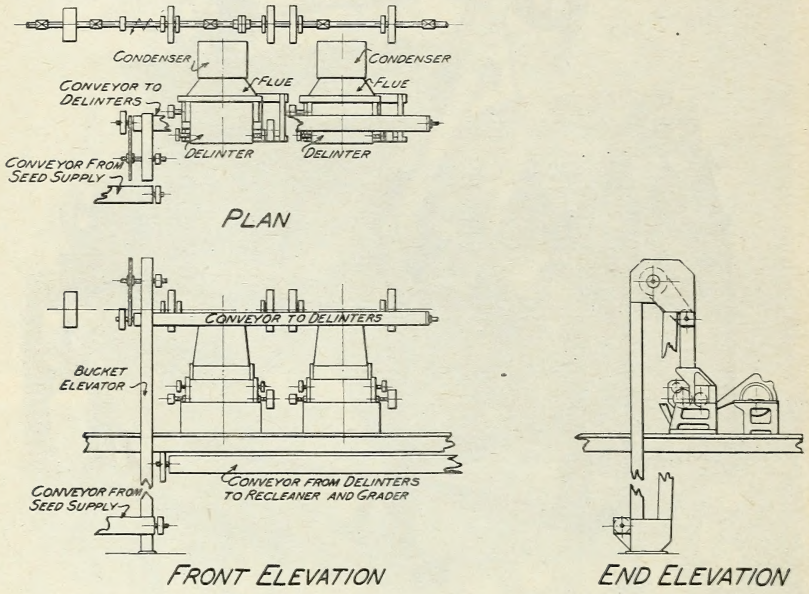

FIG. 3.—General lay-out or plan of two-unit delinting plant. Note: No attempt is made here to show the details or to suggest a fixed plan of installation. Manufacturers no doubt will be glad to cooperate with prospective buyers in working out the most economical and efficient plan of installing and operating such machinery under varied conditions and for any special requirements.

in connection with these estimates. Many dealers in planting cotton seed already have warehouses or gin buildings in which the machinery may be installed, possibly with slight alterations. The same capacity plant installed in or in connection with a ginnery costs about $500 less because all parts of the equipment, the press for example, are not necessary. Figure 3 shows a general layout or plan of a 2-unit delinting plant.

A plant of this capacity in operation 125 days of 10 hours each in in a season would delint 500 tons at a net cost of approximately $5 per ton of delinted seed. In arriving at this figure, the cost has been distributed among the various factors as follows:

Labor cost, 2 men at $2.50 per day, daily $5; per ton	$1.25
Power cost, daily $6; per ton	1.50
Dockage per ton, linters removed, 60 pounds; dirt, trash, 90 pounds; total 150 pounds at $40 per ton (value of the gin-run or undelinted seed	3.00
Depreciation at 10 per cent, $350; per ton	.70
Interest on investment at 5 per cent, $175; per ton	.35
Total	6.80
Less value of linters removed, 60 pounds at 3½ cents	2.10
Net cost of delinting 1 ton of gin-run resulting in 1,850 pounds of delinted seed	4.70
Net cost of delinting 100 pounds of delinted seed	.254
Net cost of delinting 1 ton of delinted seed	5.08

It should be understood that these figures are given only as an indicator of the approximate cost and of the factors which must be taken into consideration in determining the cost. The relative importance of these factors will vary from time to time. It will be noted that "dockage" appears to be the greatest item of cost. In addition to the linters removed there is always more or less loss in weight of the seed through the removal of dirt and trash by passing through the delinting machines. The total dockage must be charged for at the value of the "gin-run" or undelinted seed. In the example given this value is assumed to be $40 per ton. To reduce this heavy charge against dockage there are 60 pounds of linters to which are assigned a market value of 3½ cents per pound, or $2.10.

To offset further the loss of 150 pounds per ton dockage which has been charged to the cost of delinting there is the fact that the number of seed per pound increases in an equal or a greater proportion than the percentage of dockage. In this case the total dockage is 7.5 per cent, while the number of delinted seed per pound is approximately 8 per cent greater than the number of gin-run seed. The greater number of seed per pound increases the commercial value and planting capacity per unit.

A plant of one-half this capacity may be installed at $700 to $1,000 less. The net cost of delinting cotton seed in such a plant when operated 125 days per season is about $7.50 per ton, or approximately 50 per cent greater than in the larger plant. The capacity of plant to be installed by a dealer will depend upon the volume of seed handled, keeping in mind the fact that 125 days is about the maximum season's length and that the output of the plant may be doubled by operating two shifts, or 20 hours.

If a plant is installed and operated in connection with a ginnery, the cost of delinting is a few cents per ton less, chiefly because of the relatively smaller investment, which reduces slightly the interest and depreciation, all other factors remaining practically the same. If the

seed as it comes from the gins contains an appreciable quantity of stones and dirt, it may be found advisable from the standpoint of economical upkeep of the delinting machines to install a cleaner through which the seed should pass before entering the delinters. A cleaning machine of this kind that will do effective work in removing stones, metallic substances, dirt, and loose lint from the seed, reducing the frequency of filing the saws, and producing a higher grade of linters, may be purchased at relatively small cost. In the absence of such a machine similar results may be obtained by equipping the delinting machines with magnets at a cost of $30 to $35 for each machine.

LINTERS CUT PER TON OF SEED.

One of the most important factors in delinting cotton seed for planting purposes is the quantity of linters that may be removed per ton or how close the linters may be cut without injuring the germination. The exact quantity can not be fixed because it will vary with the condition of the seed as it comes from the gin and to some extent with the different varieties. Usually more linters are obtained from seed ginned early in the season when the cotton is somewhat green than from seed ginned later or when the cotton is matured and dry. The normal rate of delinting by the cottonseed-oil mills is about 75 pounds per ton.

During the season 1916–17, because of the abnormal demand for linters for munition manufacture, an average of about 150 pounds was cut. This shows the possible extent to which the seed may be delinted, but such drastic action is liable to injure the germination. Probably 60 pounds is a safe rate of cut when the seed is intended for planting purposes. The appearance and condition of the delinted seed is the most reliable indicator as to whether the lint is being cut close enough. The operator can ascertain after a few minutes' run whether any of the seeds are being injured or whether surplus lint is being left on them, and he can easily and quickly adjust the delinters so as to cut at the proper rate.

The efficiency of this operation, as in ginning, depends to a great extent on the experience and skill of the operator and the proper care and adjustment of the machinery. The object is to cut the lint as short and to make the seed as near uniform in appearance as is possible without injury to the germ. Seeds delinted lightly and heavily, compared with gin-run, are shown in figure 4. Injury may be detected by noting whether the hulls of any of the seeds have been cut through or broken by the saws. The seeds thus cut or broken should be less than 1 per cent. (See illustration of cut and broken seeds in fig. 5.)

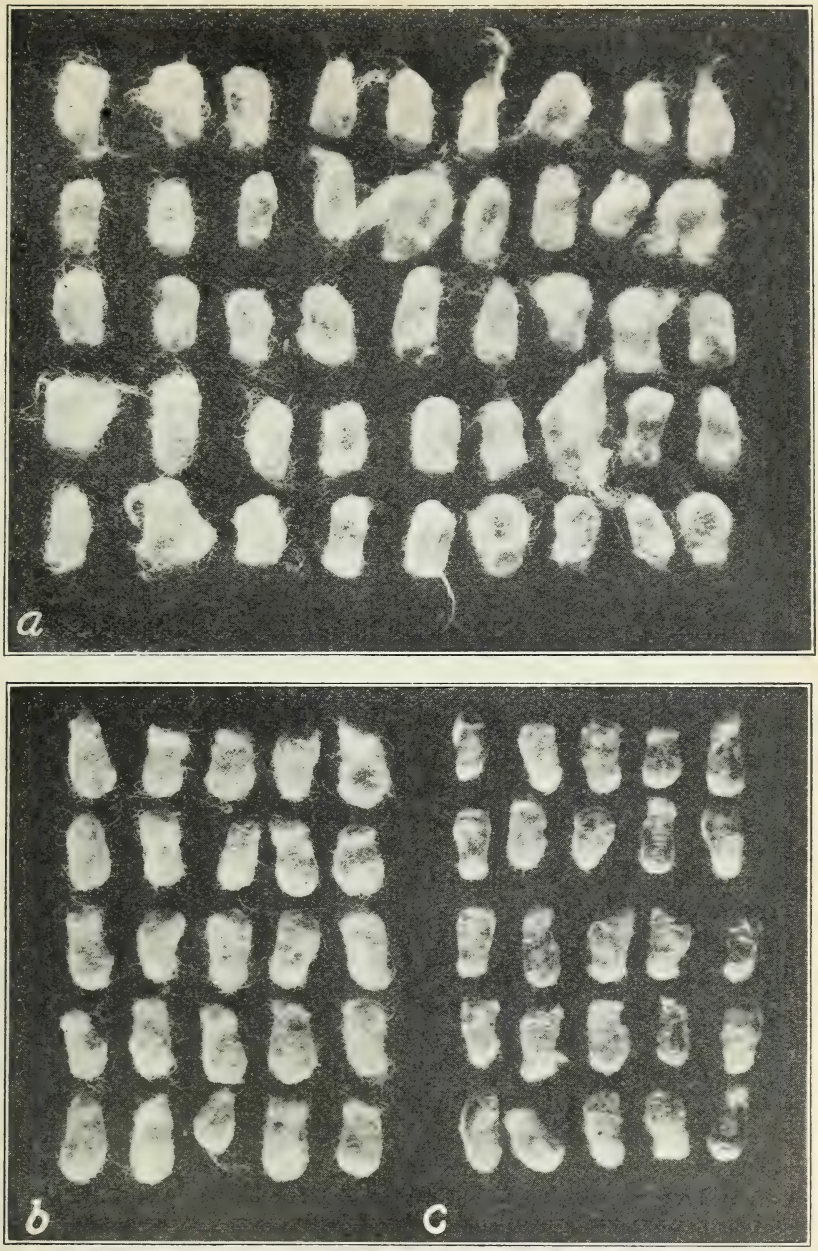

FIG. 4.—Cotton seed: *a*, Gin-run; *b*, delinted lightly; *c*, delinted closely, but no seeds cut or broken and very little of the black or slick hull showing. All natural size.

WEIGHT AND SIZE OF DELINTED SEED.

Delinted seed, although containing more seed per pound, is not so bulky as gin-run seed. For example, 30 pounds of gin-run seed may fill a bushel measure and contain 120,000 seeds, whereas this same lot

of seed when delinted would weigh about 27¾ pounds and measure only approximately four-fifths of a bushel. However, it would still contain the same number of seeds (1[illegible],000) and have the same or a greater planting capacity. Also it should be remembered that if 30 pounds (a bushel measure) of gin-run seed contain 120,000 seeds, 30 pounds of delinted seed contain approximately 130,000 seeds and have a proportionately greater planting capacity, although they may not fill a bushel measure. The number of seeds per pound or per bushel varies with the different varieties of cotton, some of which have much larger seeds than others, but a given number of delinted seeds, regardless of variety, weigh from 5 to 10 per cent less and are from 10 to 20 per cent less bulky than an equal number of gin-run seeds of the same variety.

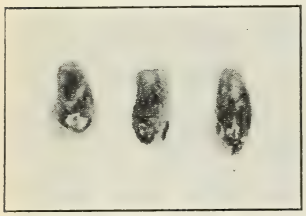

FIG. 5.—Cotton seed cut or broken by saws in delinting. Natural size.

APPEARANCE OF DELINTED SEED.

The delinted seeds have a more brownish appearance than gin-run seeds and some may be so closely delinted that the black hull shows partially as illustrated figure 6. Rarely, however, do they have the appearance of "slick seed" and there is no basis for the contention that the slick appearance of the seeds would cause farmers to be skeptical regarding the purity as to variety. Neither can delinting be construed as a cloak which might be used by unscrupulous dealers to hide inferior qualities. On the other hand, it should help indirectly to minimize the number of dealers in this class or reduce greatly the comparative volume of their business. The poorest quality of gin-run cotton seed sold for planting purposes would be improved by delinting and subsequent recleaning and grading. It is not intended that delinting should take the place of breeding, selecting, or any other phase of improving the value or productiveness of cotton seed, but that it should supplement these methods and make the most carefully bred or selected cotton seed of still greater value for planting purposes.

RECLEANING AND GRADING.

Modern and specially designed machinery is provided by all progressive dealers for recleaning and grading seeds of grains, clovers, grasses, and other field and forage crops, but seed of cotton, the all-important money crop of the South, has not received in this respect the attention by commercial agencies that it deserves. This indifference may be partly because of the fact that the necessity for and value of recleaning and grading cotton seed have not been realized

fully; consequently progress in developing machines for the purpose has been slow. Also cotton seed as it ordinarily comes from the gin still contains sufficient lint to prevent the seeds from separating readily. This makes recleaning and grading difficult and probably accounts for a number of unsuccessful attempts to operate various machines now on the market. If properly delinted, however, as described on page 10, the surplus lint is removed, leaving the seed in such a condition that recleaning and grading is greatly facilitated.

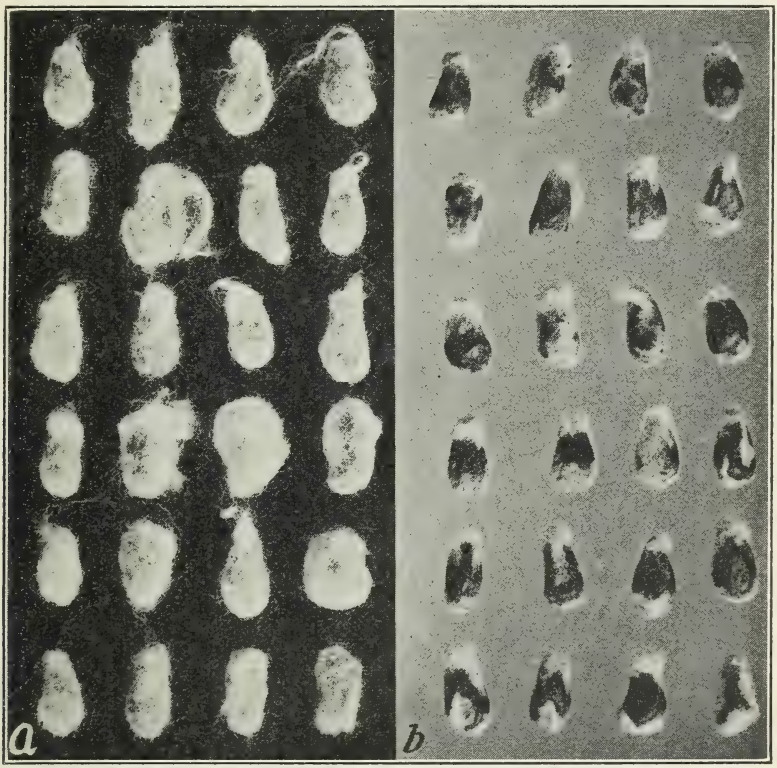

FIG. 6.—Cotton seed: *a*, Gin-run; *b*, closely delinted, showing black hull of seeds. Natural size.

The low average yield per acre is the greatest factor affecting the profitableness of the cotton-growing industry. Any practice resulting in an increased yield with only slight additional cost tends to lower the net cost of production per pound. In experiments conducted by the Bureau of Plant Industry,[7] graded seed produced from 88¾ pounds, or 8.25 per cent, to 103 pounds, or 10.9 per cent, more seed cotton per acre than ungraded seed. In preparing the seeds used in these experiments for grading it was necessary to roll

[7] Webber, Herbert J., and Boykin, E. B.: The Advantage of Planting Heavy Cotton-seed, U. S. Department of Agriculture, Farmers' Bulletin 285. 1907.

them in some finely pulverized material sprinkled with water to paste down the surplus lint or fuzz so that they would separate readily. The addition of water and any foreign material, however, introduces a possibility of error in the grading because in some cases it changes the relative weight of the individual seeds. The mechanical process of removing the surplus lint or fuzz with delinting machines, as already described, conditions the seed for any recleaning and grading operation without permitting this element of error, and without making it necessary to dry the seed.

MACHINES USED.

There are several machines in limited use for recleaning and grading cotton seed. One type is a modified air-blast cleaner or fanning mill equipped with specially designed screens. A small-sized machine of this type, operated by either hand or power and having a capacity of 3 to 5 tons per 10-hour day, may be bought at from $50 to $60. A machine of larger capacity may be had if desired. Some of the earlier machines consisted principally of a revolving screen through which the seed passed and which was supposed to remove all dirt and other extraneous matter and small inferior seeds. Another more expensive machine, combining both the revolving-screen and air-blast principles, is in use by a few dealers. A large capacity cleaner, already described on page 10, is used in oil mills to remove stones, metallic substances, dirt, and loose lint from cotton seed before it enters the delinters, but this machine does not grade or separate the seeds in any way. All light and inferior seeds are not necessarily the smallest and an air-blast separation is essential if the seeds are to be graded according to their specific gravity.

DOCKAGE IN RECLEANING AND GRADING.

The percentage of good seed lost or culled out in recleaning and grading is very small. The percentage of total dockage (dirt, trash, and light and inferior seeds) removed will vary with the cleanness and uniformity of the seed. Most of the dirt and trash, however, are removed by the gins and delinters and the dockage in recleaning and grading delinted seed consists principally of small and light-weight seed. If the cotton seed has been carefully selected and properly ginned and delinted, the dockage in recleaning should not exceed 5 per cent. The dockage, however, is not a total loss, because the seed thus culled out may be sold for other purposes at slightly less than the original cost.

Several instances are reported where dealers have discontinued recleaning and grading after a short time because of the seemingly excessive dockage and heavy loss of apparently good seed. However, the removal of the chief hindrance to this work by delinting and the continued improvement in machines designed to perform it,

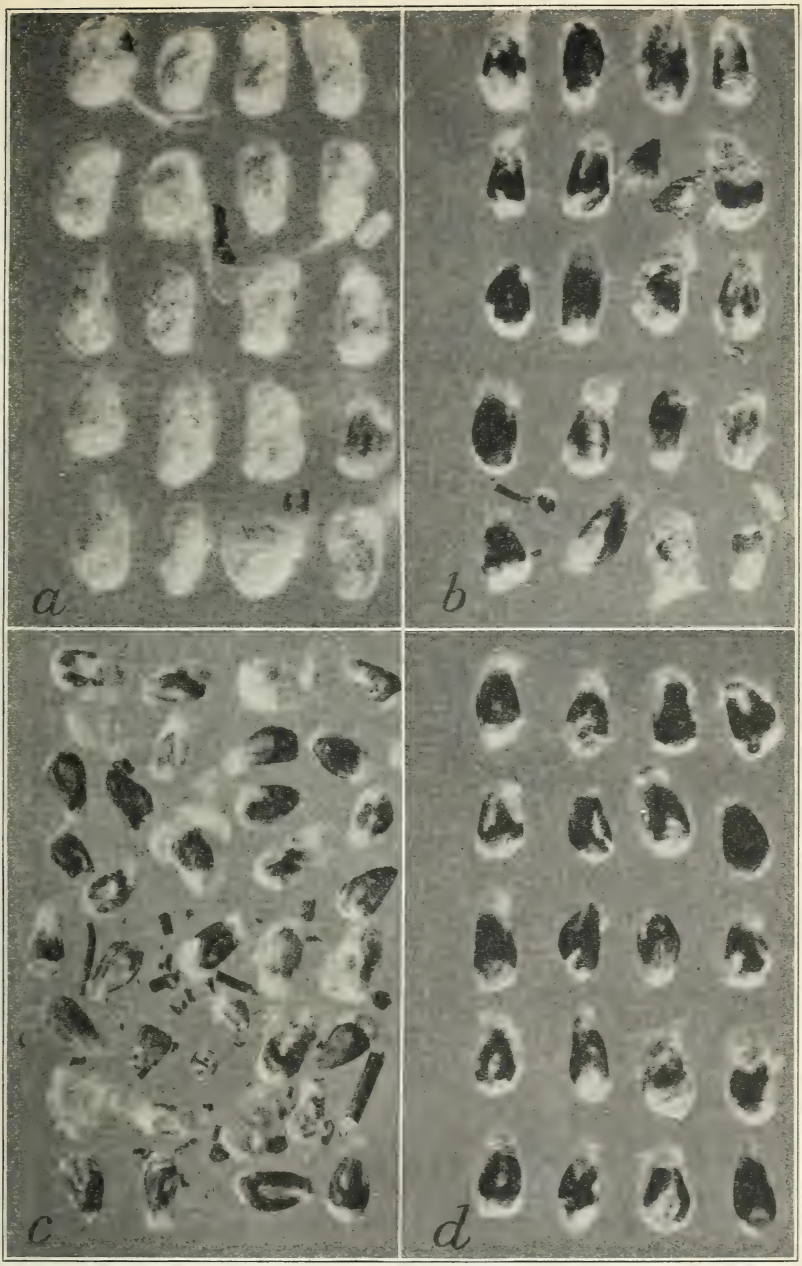

FIG. 7.—Cotton seed and classes of dockage removed in recleaning and grading. (*a*) Gin-run seed; (*b*) delinted seed, not recleaned; (*d*) delinted seed, as in (*b*), but recleaned and graded, all trash, dirt, and light-weight, immature, or otherwise inferior seeds, as shown in (*c*), being removed by recleaning and grading machine, leaving every seed a potential plant. These samples were taken from a ginning, delinting, and recleaning and grading plant in regular operation. In recleaning and grading delinted seed (*b*), resulting in the quality of seed shown in (*d*), the total dockage by weight was about 4 per cent. (Natural size.)

should be a strong incentive for dealers to reclean and grade all planting cotton seed sold by them. The results of the operation should be seeds that are perfectly clean, more uniform in weight, and higher in germination, and that contain a relatively larger quantity of the stored nutriment necessary for the development of vigorous, rapid-growing, disease-resisting, and high-producing plants. Dirty, trashy, immature, or otherwise inferior seed have no place in the economical production of cotton, and the dealer will not offer for sale and the farmer will not buy such seed if they have the best interests of the cotton growing industry at heart. Figure 7 contrasts the appearance of gin-run, delinted, and recleaned and graded cotton seed and shows the classes of dockage removed by recleaning.

SACKING.

It is economy to sack cotton seed as it comes from the recleaning and grading machine. Storing it in bulk and sacking later necessitates rehandling, and two men will be required to do the work, whereas, if the recleaner and grader is equipped with a simple elevator and bagging attachment, one man can sack the seed as fast as it comes from the machine. An automatic weigher and bagger may be used profitably where large quantities of cotton seed, either alone or in connection with other kinds of seed, are handled.

New bags, either cotton or burlap, should be used. If cotton bags are preferred, it is not necessary that they be of the heavy grade used for grass, clover, and other small seeds. However, they should be strong enough to withstand rough handling in shipment. Bags of 8-ounce burlap are satisfactory and are much used, although sometimes bags of 10-ounce burlap or heavier are preferred. The bags should have a capacity of 100 pounds, net, when sewed or tied, and be filled to even weight. The strong point in favor of a bag of this size is that cotton seed always should be sold by the 100 pounds instead of by the bushel. This point is discussed more fully on page 22. In closing the bags, sewing either by hand or machine is preferable to tying.

STORAGE.

Cotton seed may be stored either in bulk or in sacks. In either case the main precaution is to prevent the seed from heating. Investigations show that the germination of cotton seed is injured oftener by heating in storage than is generally believed. The direct cause of such heating is excessive moisture. The extent of the damage from heating is directly in proportion to the percentage of moisture contained and indirectly to the rapidity of drying. Seed cotton picked early in the season while "green" or at any time when moist and stored in a close bin or building is subject to heating. If cotton is ginned while "green" and the seed stored in large piles such seed becomes heated quickly, and constant stirring or aerating is necessary if it is to be preserved for planting.

WAREHOUSE SHOULD BE VENTILATED.

The seed should be dry when stored and the warehouse well ventilated. A warehouse admirably serving the purpose is one having a floor clearance at least 12 inches above the ground, with double walls, and having ample ventilation under the floor and between the top of walls and roof. Concrete floors are not desirable, and, if the building is of brick or concrete construction, the seed, whether in bulk or sacked, should not be piled high against the walls, as considerable damage to the seed is likely to result. If, however, it is necessary to use a building having a concrete floor, the danger of heating may be lessened greatly if not entirely prevented, by sacking the seed and stacking the sacks, in the manner outlined on page 18, on a slatted false floor built by laying 2 by 4 inch stringers edgewise on the concrete floor and nailing 1 by 4 inch strips across them leaving a 2-inch space between each strip. Similar results may be had by simply laying three 4 by 4 inch stringers on the floor about 8 inches apart and stacking the sacks on these in the same manner. Such a plan also may be used advantageously in buildings or on floors constructed of any other material.

A patented ventilating system, consisting of tubes 6 inches in diameter, made of perforated sheet metal or of heavy one-fourth inch mesh wire, which are placed upright over holes cut in the floor about 6 feet apart each way and which extend above the height of the walls of the building, has come into limited use in cotton-seed warehouses during recent years. When bulk seed is piled high in a building so equipped these tubes or "flues" provide a constant circulation of air.

If more than one variety or strain of a variety is stored in bulk in the same warehouse, separate bins should be provided and each bin marked with the lot number (see page 20) given to the particular strain or variety of seed stored therein. This arrangement will reduce the liability of varieties becoming mixed and identify the different lots. Some such means of identification is necessary because it is difficult, and in most cases impossible, to distinguish between the varieties by the appearance of the seed.

STORING IN SACKS.

Storing in sacks offers several advantages. Where the many phases of preparation are performed successively or as one continuous operation and the seed sacked at the recleaner and grader, there will be no occasion for storing in bulk. When sacked, the seed may be moved or transferred at will and shipments made with the least possible delay. Also when the bags are arranged in the warehouse in the manner described in the following paragraph, injury to the germination by heating is not so likely to result as when stored in bulk. The bags should be stenciled immediately after sacking with the lot number assigned to this particular lot of seed.

The best position for the stenciled number is across the top of the bag. In this position it will be visible when the bags are standing on end or when stacked or piled. All bags bearing the same lot number should be kept together and placed or stacked in the same section of the warehouse.

STACKING.

In stacking, it will be found advisable to alternate the position of the bags in each layer by placing a double row end to end in the first layer, and in the second or succeeding layer placing them parallel to each other and crosswise or at right angles to those in the first or preceding layer. This provides a stack or pile the width of the length of a bag and any desired height and length that the dimensions of the warehouse will permit. A space of at least 6 inches should be left between each stack or pile and between the bags and the walls. Such arrangement permits a free circulation of air and reduces greatly the possibility of heating.

GERMINATION.

All other factors being equal, the value of a given quantity of seed is in direct proportion to the percentage that will grow. Regardless of this fact, a widespread belief exists that the making of germination tests of planting cotton seed is of minor or secondary importance. This belief is based largely on two factors: (1) That seed from mature cotton harvested under favorable conditions and stored properly will germinate satisfactorily, and (2) that the heavy rate of seeding employed by most farmers will give a good stand of plants although a large percentage of the seed may not grow. These factors are true to a limited extent. However, two lots of seed may be handled and stored in exactly the same manner and yet there may be a wide difference in the percentage of germination. Also the farmer who buys planting cotton seed is entitled to know, so far as practicable, what percentage may be expected to grow in order that he may effect a corresponding saving in the cost of seeding by adjusting accordingly the quantity to be sown per acre.

The results of germination tests made by the Seed Laboratory, Bureau of Plant Industry, of samples submitted to the Bureau of Markets and Crop Estimates show that there is a wide variation in the viability of cotton seed sold for planting purposes. This variation occurs not only between the samples submitted by different dealers but also between the percentage of germinable seed in each of two or more samples submitted by the same dealer. For example, of the 1919 crop, one of five samples of as many varieties submitted by a dealer tested only 56 per cent, while the other four ranged from 80 to 93 per cent; and of the 1920 crop, one of four samples submitted by another dealer tested only 59 per cent, the other three 88, 88, and 94.5 per cent.

With further reference to the 1919 crop, the percentage of germination of the 70 samples tested ranged from 45 to 96 per cent, aver-

aging 82.5 per cent. Twenty-one of the samples tested 90 per cent or over, averaging 92 per cent; 28 tested 80 to 89 per cent, inclusive, averaging 85.7 per cent; these 49 samples tested 80 per cent or above, averaging 88.4 per cent, while the remaining 21 samples (30 per cent of the total) germinated less than 80 per cent, with the low average of 68.8 per cent. The 1920 crop samples tested averaged 85.3 per cent, or 2.8 per cent higher than those of the 1919 crop. This was to be expected because of the more favorable weather generally for harvesting the 1920 crop. However, of the 89 samples submitted, 17, or nearly one-fifth of the total, germinated less than 80 per cent, with the same low average of 68.8 per cent. If germination be used as the basis of values, the 1919 crop lots testing 80 per cent and over, averaging 88.4 per cent, are worth 28.5 per cent more, and the 1920 crop lots testing 80 and over, averaging 89.1 per cent, are worth 29.5 per cent more than those testing less than 80 per cent and averaging only 68.8 per cent.

CAUSES OF LOW GERMINATION.

Low germination may be caused by unfavorable weather conditions, delay in harvesting, and heating in storage. A severe drought during August and September usually results in immature or undeveloped seed of low viability. Wet weather, extending over a period of a week or more, causes more or less damage to the germination of the seed by the continued presence of excessive moisture in the bolls. Tests are on record [8] of seed from cotton harvested after a long rainy season which averaged only 55 per cent germination and which ran as low as 29 per cent. Also tests [9] of seed from cotton harvested in the early fall months showed an average of 90 per cent germination, while that from mature cotton harvested in January averaged only 43 per cent, and from frosted cotton harvested during the same month only 14 per cent germination.

MAKING TESTS.

One or more representative samples of each lot of seed should be taken at the time of sacking, and marked with the lot number, for use in making germination tests. The sample should contain at least 1 ounce of seeds, about 300, in order that duplicate tests, using 100 seeds in each, may be made and a part of the sample retained for check. If there is any probability that a lot of seed has become damaged, from any cause, prior to harvesting and ginning, such seed should be tested as soon as ginned or delinted, and held in bulk pending the results of the germination test before being recleaned and sacked. With the possible exception of cases where there may be a shortage of high germinable seed of a particular variety, there is no

[8] Arkansas Agricultural Experiment Station, Circular 22: Testing Cotton Seed for Germination.

[9] Arkansas Agricultural Experiment Station, Circular 37: Cotton Seed for Planting Purposes.

reason for retaining damaged seed for planting purposes. If such seed is sold for planting purposes a second test should be made at the time it is sacked and sales should be made on the basis of this latter test.

The equipment necessary in making reliable germination tests is not expensive. Commercial germinators are on the market at around $50. Tests also may be made in sand or soil or by the use of blotting paper or canton flannel placed between ordinary dinner plates and kept warm and moist. Samples also may be sent to the Seed Laboratory, Bureau of Plant Industry, Department of Agriculture, Washington, D. C., or to the Branch Seed Laboratory, College Station, Tex., for test without cost.

The method of making the test will depend upon the nature of one's relation to the planting cotton seed business and the quantity of seed sold annually. The main point is that a reliable test should be made. The method of testing by cutting the seed with a knife and examining and tasting the kernel is inaccurate, if not fallacious, can not be relied upon, and should not be used or advocated.

It is not proposed to fix a minimum or a standard percentage of germination at this writing, but rather to show that germination directly affects the commercial as well as agricultural value of planting cotton seed. The comparative commercial value of different grades of seed is governed largely by their agricultural value. A dead seed has no value for planting purposes. For this reason it is essential that accurate records of germination tests be kept so that the information may be passed on or made available to the farmer or other purchaser. These records should include the lot number of the seed from which the sample was taken, the date on which the test was made, and the percentage of germination as shown by the test. The duration of the test and any general remarks having a bearing on the viability of the seed or the vigor and healthfulness of the prospective young plants may be included.

THE SHIPPING TAG.

In addition to carrying shipping directions the shipping tag or label should also contain the following basic information which will aid the buyer in determining the true value of cotton seed: Lot number, variety, where grown, year grown, percentage of germination, and date of test. Many States in the cotton belt have enacted seed laws which require that additional information, such as the percentage of each of pure seed, weed seed, and inert matter, and the names of noxious weed seed present, be shown on the label attached to shipments of seeds, including cotton seed.

THE LOT NUMBER.

The lot number is the key to the identity of any particular lot of seed. If dissatisfaction arises over a shipment, the lot number on the

shipping tag or on the bag, with the aid of properly kept records, will aid in tracing the lot of seed from which the shipment in question was taken, through each step of its preparation for the market back to its source of production. The original cause of the dissatisfaction would thus be located and responsibility properly placed. Information regarding the name and address of grower, location of farm, variety grown, and origin of stock seed as well as data on germination referred to on page 20 also should be recorded in connection with each lot number.

SELLING.

The indiscriminate buying and selling of field-crop seeds with little or no regard for the purity of variety or genuineness of strain is one of the greatest evils in the seed trade. A sale of cotton seed for planting purposes represents something more than ordinary merchandising. It has a direct bearing on the crop that may be produced. The value of the seed is potential, not apparent, and the farmer in making purchases has to rely almost wholly on the integrity of the seller and the accuracy and completeness of his statements.

EXTRAVAGANT CLAIMS UNDESIRABLE.

A glance at the advertisements, catalogues, circulars, and other printed matter issued by various cotton-seed dealers will disclose many extravagant claims and inconsistent statements. In some cases these claims are gross misrepresentations, and are never sustained except under the most favorable conditions or by the sacrifice of other equally important characteristics. The outstanding inconsistency in such statements is the fact that in many cases they attempt to describe the good points of a variety and to show its agricultural possibilities when an examination of the seed for sale would show it to be mixed, poorly ginned, and often low in germination. Farmers generally are familiar with the description and characteristics of the most widely grown varieties of cotton, and it is of far greater importance for dealers to give assurance that the seed offered for sale is pure as to variety, in good physical condition, and of high germination. The policy of simply listing cotton seed by its true variety name and stating in detail the conditions under which a particular lot was produced, special methods employed in preparing it for planting purposes and for market, and the percentage that may be expected to grow would indicate more clearly its actual commercial and agricultural value. The farmer, the ultimate purchaser and consumer, being already familiar with the possible results to be obtained from planting a particular variety of cotton, should be more interested in knowing whether the lot of seed purchased is pure, unmixed, well ginned or delinted, recleaned and graded, and of high viability. Cotton seed with each individual seed a potential plant, not descriptive variety information, is the commodity to be sold or to be purchased.

TRUE NAMES FOR VARIETIES.

The number of variety names used by growers and dealers in selling planting cotton seed during comparatively recent years runs into hundreds. Over 50 variety names are employed by dealers at present. A number of these names, however, are merely trade names and do not represent a distinct variety. The diversity of designations for the same variety is still further increased by applying various descriptive terms. For example, the King variety is found to be listed in 12 forms as follows:

King.
King's Early.
King's Improved.
Early King.
Improved King.
Re-Improved King.
King's Extra Early.
King's Early Improved.
Re-Improved Early King.
Faultless Bred King.
King's Improved Extra Early.
King's Extra Early Big Boll.

The names of many other varieties are altered in much the same manner. A farmer in the market for cotton seed would have difficulty in determining from such an array of titles when he was getting the best value or the highest grade of seed of the desired variety. To apply complex adjectives to the true variety name not only confuses but in some cases may mislead the buyer. Sometimes dealers use only such descriptive phrases as "Big Boll Early," "Early Prolific," etc., without tying them up to the variety name or indicating in any way what variety is represented. Such practices should be discontinued.

RENAMING VARIETIES.

The practice of renaming varieties of cotton has been greatly abused. To grow or purchase cotton seed of a well known or common variety or of mixed varieties, and sell it under an unknown name with glowing descriptions, implying that results hitherto not attained may be expected, is a policy to be condemned. Practices of this kind serve only to bring the planting cotton seed business into disrepute and tend to discredit the honest efforts of conscientious seed breeders and dealers. The latter should be encouraged because the development and distribution of new varieties and improved strains maintain or raise the standard of cotton production to a great extent. When seed of a new variety of cotton is offered to the public, its origin, method of developing, tests made and results obtained, its soil, climatic, and regional adaptations, and the reputation of the originator are factors which should be considered in passing judgment on its true value. The seller should see that these facts are stated fully and accurately and made available to the buyer.

SALES ON BASIS OF WEIGHT VS. MEASURE.

The sale of planting cotton seed on the basis of weight rather than measure is strongly urged on all persons or concerns handling this commodity. It seems inconsistent, to say the least, for planting cot-

ton seed to be sold on the bushel basis when the market for cotton seed for manufacturing purposes, which quantity is ten times as large, is firmly established on the 100-pound or ton basis. The outstanding argument in favor of sales for planting purposes being made on the 100-pound or ton basis, however, is the wide variation in the established legal weights per bushel in the cotton-producing States. In North Carolina, South Carolina, and Georgia the legal weight per bushel of upland cotton seed is 30 pounds; in Alabama, Mississippi, Oklahoma, and Texas, 32 pounds; in Arkansas 33⅓ pounds; and in Tennessee, only 28 pounds. At the present time most dealers in the various States do not adhere strictly to the legal bushel weights designated, but avoid any probable recourse in transactions by quoting prices per bushel of a specific number of pounds, which may or may not be the prescribed legal weight in their respective States. Although the legal weight of a bushel varies from 2 to 5 pounds in different States, the pound remains constant, and the difficulties and misunderstandings attending the lack of uniformity in bushel weights can be avoided by adhering strictly to the practice of quoting prices per 100 pounds.

CERTIFIED COTTON SEED.

In view of the fact that authentic information or assurance regarding the purity as to variety and trueness to type of cotton seed has an important bearing on its value for planting purposes, it seems that some system of certification would be desirable. Certified seed of potatoes, rye, alfalfa, and a few other crops are available in limited commercial quantities, but little work of this kind has been done with reference to cotton. The registration, inspection, and certification of cotton fields from which planting seed is to be selected, by some disinterested agency, would go a long way toward providing a commercial supply of cotton seed pure as to variety and true to type. It remains for State and Federal agricultural agencies to work out a method that will be practical in its application and that will effect the desired results. Certified cotton seed, however, with all that the term implies, would not represent the ultimate in planting cotton-seed values unless the seed also be subjected to approved methods of preparation and marketing.

SUMMARY.

The ideal planting cotton seed may be described as seed selected from cotton that is true to type and pure of variety, well matured, free from disease and insects or insect injury, delinted, recleaned and graded, and testing a minimum of 88 per cent germination.

It is necessary that the stock seed used in producing cotton from which commercial planting seed is selected should compare favorably with the ideal.

The more thorough and uniform removal of the surplus lint and culling out of all extraneous matter and small or light inferior seed

would result in a possible reduction of 100,000 tons of cotton seed in the annual seeding requirements and a saving of 30,000,000 pounds of linters for industrial purposes which are now wasted.

The cost of delinting should not exceed $5 per ton, while the agricultural value of the process in promoting quicker and more uniform germination with less seed per acre is much greater.

Delinting also facilitates recleaning and grading by removing the surplus lint or fuzz which prevents the seeds from separating readily when subjected to an air blast or when passing over a screen.

The results of recleaning and grading are clean seed, uniform in weight, high in viability, and containing a relatively larger quantity of stored nutriment necessary to the production of well-developed, vigorous, rapid-growing, disease-resisting, and high-producing plants.

It is economy to sack cotton seed as it comes from the recleaning and grading machine. The bags should have a capacity of 100 pounds net when sewed or tied and be filled to even weight.

Cotton seed stored in sacks and stacked so as to permit ventilation is less subject to heating, which seriously impairs germination.

All other factors being equal, the value of a given quantity of planting cotton seed is in direct proportion to the percentage that will grow, and a reliable test of the germination of each lot should be made and sales made on this basis.

The shipping tag should convey the following information to the buyer, the farmer: Lot number, variety, where grown, year grown, percentage of germination, and date of test.

The lot number is the key to the identity of any particular lot of cotton seed, in connection with which records should be kept regarding the name and address of grower, location of farm, variety, and origin of stock seed, as well as data on germination.

Listing cotton seed by its true variety name and stating more in detail the conditions under which it was produced, special preparation given it for planting purposes and for market, and the percentage of germination indicates more clearly than present methods its actual commercial and agricultural value.

There is a difference of 2 to 5 pounds in the legal bushel weights of upland cotton seed in the various cotton States, and the sale of planting cotton seed on the basis of weight instead of measure is strongly advocated.

The registration, inspection, and certification of cotton fields from which planting seed is to be selected, by some disinterested agency, would go a long way toward providing a commercial supply of cotton seed pure as to variety and true to type, but this would not represent the ultimate in planting cotton seed values unless it is delinted, recleaned and graded, and of the highest practicable percentage of germination.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1922